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Extended Warranties in Army's Acquisition Contracts

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December 2012

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With the current fiscal constrains placed on the Army to help combat the national debt, the acquisition community must find cost savings avenues without sacrificing mission readiness. During the acquisition process in the DoD, extended warranties are often made available by a supplier, a third party, or through self-insurance. The cost impact of extended warranties can be significant. Furthermore, the ability to service and maintain equipment, either at sea or on land, has a critical impact on the Army's and the DoD's mission capability. I will do a review of warranty planning system in the Army and provide a case study on the purchase of 55 Hewlett Packard Laser Printers in Afghanistan to illustrate the potential cost savings by electing to use extended warranties based on a formal model and simulations in order to bridge the gap between the academic literature and the professional experiences of the service members in order to help solve the difficult task of determining the terms of extended warranty contracts and its value to the Army.

While warranty planning is not required, it can potentially save the Army millions of dollars in day to day commercial products acquisitions. The result of the model and simulation show that by making a large upfront purchase of an extended for 3 years versus the free standard warranty of one year, the unit can save on average 11.16%. Due to the budget constraints, Contracting Officers with the assistance of everyone in the acquisition process should emphasis extended warranty purchase in commercial products to reduce risk and lengthen the life-cycle replacement cost to the government. The Army has a regulation emplace for the warranty management program in AR 700–139, but I believe more guidance is needed from the Army's key leadership in order to fully realize the cost savings from extended warranties.

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EXTENDED WARRANTIES IN ARMY'S ACQUISITION CONTRACTS

Vinh B. Nguyen, Major, United States Army

Submitted in partial fulfillment of the requirements for the degree of

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LIST OF ACRONYMS AND ABBREVIATIONS

DoD – Department of Defense

DoDFMR – DoD Financial Management Regulation

SJA – Staff Judge Advocate

AR – Army Regulation

DOL – Directorate of Logistics

ARNG – Army National Guard

USAR – United States Army Reserve

WAC – warranty action claims

DFARS – Defense Federal Acquisition Regulation Supplement

SB – Sustainment Brigade

HP – Hewlett-Packard

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I. INTRODUCTION

In the Federal Acquisition Regulation 1.102a, the vision for the Federal Acquisition System is to deliver on a timely basis the best value product or service to the customer, while maintaining the public's trust and fulfilling public policy objectives. With the current budget cuts in military spending, everyone involved in the acquisition process must find other means to maintain operational readiness while maximizing benefit to the government which is currently cost savings. Taxpayers are demanding increased transparency and accountability in military spending. As part of the acquisition process, everyone involved must conduct due diligence in ensuring attention is giving to mission readiness with savings in mind. One approach is to simplify the assessment of whether or not to purchase extended warranties. Currently, the contracting officer has the authority to make a subjective determination to pursue a warranty or not.

Warranties are universally known as protection against product defects. However, the Department of Defense (DoD) sees the use of warranties as risk management with tailoring the warranty concept to fit the item and its intended use in a comprehensive manner with minimal impact on standard Army logistical procedures. Army Regulation 700–139 (Army Warranty Program) stated that warranty tailoring is intended to protect the Army from the costs and frequency of systemic failures, to enact responsive remedies for failures of significant operational impact, to minimize or eliminate warranty execution tasks at the MACOM, and to become one of the methods used to require the contractor to fulfill the obligation of providing quality Army items (AR 700–139, 3). Four basic warranty concepts are used in AR 700–139:

- Failure-free warranty. This is sometimes known as a zero-defects warranty. The contractor is required to deliver a product that conforms to contractual requirements after acceptance. The prime advantages are simplicity, early identification of defects, and easy administration. The primary disadvantage is the higher cost due to the contractor's assumption of more risk. This is often used as an incentive warranty.
- Expected-failure or threshold warranty. This warranty is triggered only after a certain number of failures is reached. This is a form of assurance warranty. There is a reduced risk to the contractor. This warranty recognizes that malfunctions will occur despite the best design and

manufacturing processes. The principle disadvantage to the government is the intensive data collection, recording, and accounting that must be conducted.

- Systemic warranty. A systemic defect is one that occurs with a frequency, sameness, or pattern to indicate a logical regularity that exceeds predicted failure rates. The government assumes that all systems produced under like circumstances are defective. The principal advantages to the government are reduced costs and the avoidance of complicated reporting, tracking, and accounting requirements. The warranty is more apt to treat a cause than a symptom. There is normally a high procurement cost associated with this type of warranty.
- Defect-free warranty. This warranty directly relates to contractual nonconformance rather than hardware failures. It recognizes that not all defects result in failures and not all failures result from defects. It has little impact on the user, is easy to administer, and is normally cost effective.

However, AR 700–139 does not define or mention anything about extended warranties. An extended warranty offers the opportunity for a consumer to extend coverage after the base or standard warranty expires (Hartman, 1). Extended warranties can provide additional benefits to the Army by extending the coverage of the four types of warranties defined by the Army Warranty Program. During the acquisition process in the DoD, extended warranties are often made available by a supplier, a third party, or through self-insurance. The cost impact of extended warranties can be significant, but can save the military future dollars in buying replacement equipment. This could include the reduction of the depot-level and field level repair workload for DoD employees, risk aversion to loss of uptime resulting from defective parts, and protection against suppliers abandoning a product in favor of new technology (Myung, 2012). An extended warranty could not only be cost beneficial, it could also meet the vision for the Federal Acquisition System. Furthermore, the ability to service and maintain equipment, either at sea or on land, has a critical impact on the Army's and the DoD's mission capability. I will do a review of warranty system in the DoD, including basic statistics, provide a case study on a recurring procurement in Afghanistan, and adapt a formal model and help bridge the gap between the academic literature and the professional experiences of the service members in order to help solve the difficult task of determining the terms of extended warranty contracts and its value to the Army.

While warranty planning is not required, it can potentially save the Army millions of dollars in day-to-day commercial products acquisitions. The result of the model and simulation show that by making a large upfront purchase of an extended for 3 years versus the free standard warranty of one year, the unit can save on average 11.16%. Due to the budget constraints, Contracting Officers with the assistance of everyone in the acquisition process should emphasis extended warranty purchase in commercial products to reduce risk and lengthen the life-cycle replacement cost to the government. The Army has a regulation emplace for the warranty management program in AR 700–139, but I believe more guidance is needed from the Army's key leadership in order to fully realize the cost savings from extended warranties.

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II. LITERATURE REVIEW

In order to find out how the Army uses extended warranties, I have separated this section by the groups in the acquisition process (see Figure 1). The Acquisition Process is where policy does not meet practice. Warranty planning is supposed to be a focus in all sections, but is largely ignored with the exception of the Contracting communities because Army and Federal regulations does not required them to do so. The deemphasize on warranties could be traced to Eleanor R. Spector the Director, Defense Procurement who on February 6, 1998 amended the Subpart 246.7 of the Defense Federal Acquisition Regulation Supplement (DFARS) to implement Section 847 of the National Defense Authorization Act for Fiscal Year 1998 (Pub.L.105–85) which repeals the requirement for contractor guarantees on major weapon systems (1). We will continue to look at the process to find the disconnect, and who has the actually ability to influence the warranty plan.

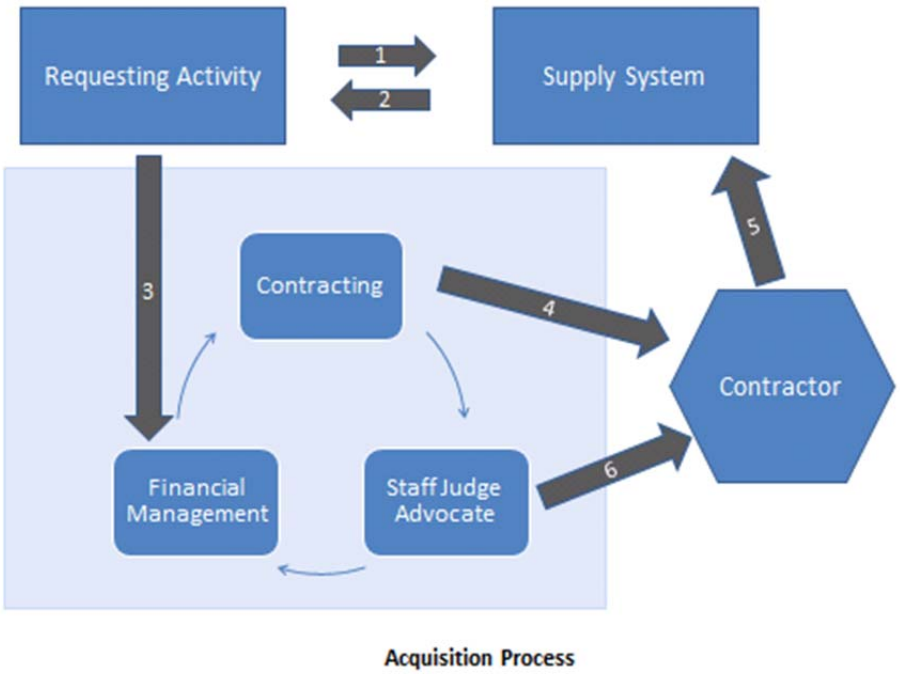

Figure 1. Army Acquisition Process

The Acquisition Process illustrates where the idea of using the warranties begins and what groups have an ownership on the warranty plan. The Requesting Activity initiates the acquisition process thru the Supply System. If the requisition can be filled in the Supply System, then the acquisition process ends. If not, the requisition goes back to the Requesting Activity so that they can compile a procurement package for submission to the Fiscal Triad.

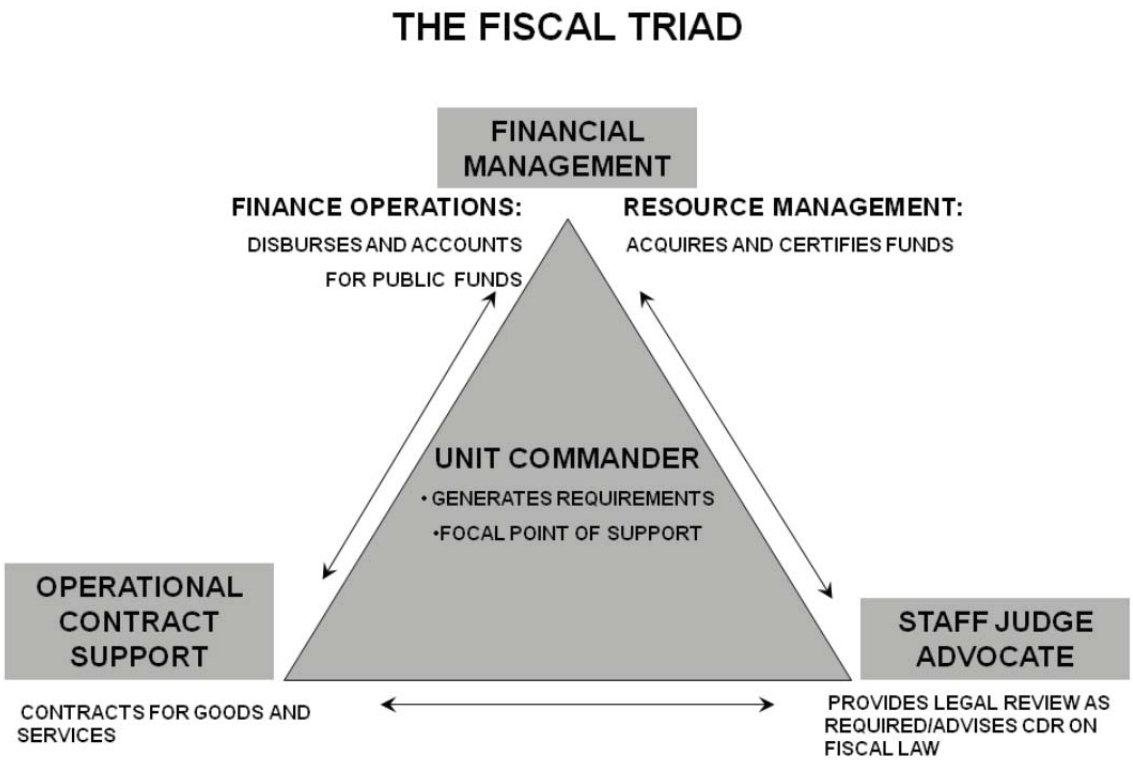

Figure 2. The Fiscal Triad from FM 1–06

The Fiscal Triad consists of the Financial Management, Contracting Activity, and Staff Judge Advocate (SJA). The Comptroller in the Financial Management commits the funds while the Contractors procure the request for the requesting activity and sent to the supply system for accountability according to public policy and federal regulations. The Disbursing Section in will pay for the procurement when all the documents are in order.

Once paid, the cycle is complete with the Comptroller obligating the funds and de-obligating unused dollars. Only the Contracting Activity in the Fiscal Triad takes part in the planning for the warranty.

Requesting Activity. The requesting activities are the end users such as the warfighters out in the front line using the equipment or services. The requesting activity can also be the program manager in charge of procuring the development of a new weapon system. When the warfighters or program managers need new equipment, weapon systems or services, they must check with the supply system to see if the capability is already in stock or on order. If the requirement can't be filled by the supply system, then the requesting activity will have to put in a paperwork package to obtain funding for the procurement of the equipment, weapon system, or services. Warranties or extended warranties are a nonissue at during the initial request. However, once the requirement is filled by the contractors, the requesting activating can submit warranties claim if the equipment are under warranties and ensure the warranty execution is carried out according to the standards set forth by Army Regulation (AR) 700–139, The Army Warranty Program. But in practice, the Requesting Activity doesn't partake in the warranty plan. However, in the regulation, they are required to follow the guidelines.

Under AR 700–139, the requesting activities (MACOM commanders) will—

a. Assure that a WCA is filed through the AEPS Website (http://aeps.ria.army.mil) warranty action claims (WAC) section for each failure of an item covered by a warranty.

b. Establish nonstandard execution procedures (para 5–2b) in coordination with the acquisition organization when nonstandard procedures are approved by the MACOM for the maintenance augmentation capability.

c. Provide suggestions or advice on the scope and methods of warranty execution as requested by the acquisition organization.

d. Notify the acquisition organization when published execution procedures prove unsatisfactory or result in extensive administrative burden.

e. Include warranty functions within annual MACOM budget submissions to provide for the administration of the warranty program.

f. Establish a WARCO at the MACOM level. MACOM WARCOs will—

1. Review and coordinate the acquisition organization warranty execution procedures within MFPs, warranty technical bulletins (WTBs), and related warranty data to assure effective execution of warranties.

2. Develop local written instructions for warranty execution and management within the MACOM.

3. Establish a coordinating subordinate WARCO function at MACOM-determined levels (such as corps, division, materiel management center, and area maintenance support activity) when appropriate.

4. Direct the subordinate servicing WARCO function at the Directorate of Logistics (DOL) for installation management organizations; at Sustainment maintenance for military organizations; at the State Maintenance Office within the Army National Guard (ARNG); and at Army Reserve Commands for the U.S. Army Reserve (USAR).

The Department of the Army warranty regulations adds to the DoD's warranty guide, but cannot take away any regulations from higher. The DoD's warranty guide states that the requesting activities should participate in the warranty planning efforts, but is not required. However, if it is the Program Manager then he or she is responsible for setting up a warranty planning team according the DoD's warranty guide. The Program Manager is overall responsible for the warranty planning (DoD Warranty Guide, 2009, p. 7). The Program Manager must be able to communicate with all the sections in the acquisition process to ensure if a warranty or extended warranty is needed.

Supply System. The Deputy Chief of Staff, G-4 is the proponent for the Army Warranty Program with the authority to approve waivers and exceptions. The Commanding General of U.S. Army Materiel Command (AMC) will be the actual one managing the Army Warranty Program. His responsibilities according to AR 700–139 are as follows –

a. Institute policy, determine compliance, and operate data collection and reporting methods in consonance with Headquarters, Department of the Army (HQDA) objectives.

b. Sustain compatibility of warranty execution methods with the standard Army supply and maintenance logistic support systems.

c. Establish and maintain a centralized, Web-based database for all centrally procured item warranties.

d. Direct and control the centralized collection of warranty information.

e. Report annually to the DCS, G-4 on the Army Warranty Program and the effectiveness of the responsible agent.

f. Provide 24-hour/7-day electronic mailbox access to the central warranty information database.

g. Establish telephone and Web link access (24-hour hotline/Web link) for input of problems or specific warranty questions from MACOMs to AMC warranty control offices.

The AMC, CG oversees the supply system, but day to day activities in the acquisition process are done at the unit level in which they track warranties with the Army Maintenance Management System (TAMMS). Every acquisition request will have supply requisition number signed by the property book officer. The warranty tied to the acquisition will also be captured based on the requisition number to ensure accountability and tracking. The onus is on the supply officers in charge of managing the program. However, in practice like the requesting activity, the supply system isn't deeply involved with the warranty planning.

Financial Management. The Financial Management section is comprised of two sections, the Comptroller and Disbursing sections. The Comptroller allocates the funds for the requirement by committing funds for that procurement. A commitment is an administrative reservation of funds to fence in the money for the requirement based on time, purpose and amount. The commitment does not take into consideration of warranty cost but just enough for the requisition, applicable taxes, and shipping. The Comptroller will then obligate the funds when the contract is awarded for the requirement based on the negotiation and final price from the Contracting Activity. An obligation is a legal reservation of funds which means the funds used and paid by disbursing section.

The DoD Financial Management Regulation (DoDFMR) Volume 11A, Chapter 14, paragraph 0306 states all transfers of goods or services of whatever nature made pursuant to this Regulation shall be without any express or implied warranty. This is the only verbiage in the Comptroller's regulation regarding warranties. However, one of the Financial Manager's core competencies is cost planning. Cost Planning is the use of a cost model for "should cost" forecasting to make informed decisions (FM 1-06, 2011, p. 12). The "should cost" includes indirect and direct costs to the requirements for budgetary purposes. With this in mind, the comptroller should be heavily involved in the warranty planning with the contracting activity in order to ensure best practices and stewardship of the taxpayers' dollars.

Contracting. The Contracting Officer (CO) is the only one that can negotiates and enters contracts on behalf of the government to fulfill the needs of the requesting activities based on SJA legal approval and the Comptroller's obligation of funds. The Contracting Officer is a key player in warranty planning and works alongside the Program Manager to develop a solid warranty if beneficial to the government. The DoD's Warranty Guide breaks down the critical task the CO must do:

1. During the requirements definition or market research phase, the CO must clearly communicate the intent and the specifics of planned warranty provisions.

2. When determined appropriate, a warranty provision should be placed in the Request for Proposal (RFP) and the discussion of warranty should be a key topic of discussion.

3. The contracting officer shall document the decision to purchase a warranty. This documentation shall include the Chief of the Contracting Office approval citing applicable rationale and a Cost Benefit Analysis (CBA) (if applicable).

4. COs are required to obtain assurance that a capability to track and enforce reparable asset warranties exists prior to purchase.

The CO must also abide by the Federal Acquisition Regulation in which FAR Subpart 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the CO should consider placing it in the contract based on FAR Subpart 46.703 which requires the CO to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements (DoD Warranty Guide, 2009, p. 4). The argument for the warranty must be accurately documented in contract administration.

The Defense Federal Acquisition (DFARS) supersedes the FAR. The Defense Federal Acquisition Regulation Supplement Subpart 246.704 sets forth the following: "The Chief of the Contracting Office must approve use of a warranty, except in acquisitions for: (1) Commercial items; (2) Technical data, unless the warranty provides for extended liability; (3) Supplies and services in fixed-price type contracts containing quality assurance provisions that reference higher-level contract quality requirements; or (4) Supplies and services in construction contracts when using the warranties that are contained in Federal, military or construction guide specifications." (DoD Warranty Guide, 2009, p. 6). The CO must get approval from the Chief of the Contracting Office who shall approve the use of a warranty only when the benefits are expected to outweigh the cost. Therefore, the CO must work with closely with everyone in the acquisition process to document and show evidence to the Chief of Contracting Office for warranty approval.

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III. MODEL

Dr. Noah Myung and Dr. John Khawan, associate professors from the Graduate School of Business and Public Policy, Naval Postgraduate School developed a formal economic model describing when no warranty, warranty, or an extended warranty will be providedin their research, "Extended Warranty Management in the Department of Defense" (Myung and Khawan, 2012). They defined the consumer of the good (DoD) as a von Neumann-Morgenstern expected utility maximize, and labeled it as *D*. The consumer values the good purchased at $V > 0$. The price of good with the warranty is labeled *p*, and the cost of making the good is labeled as *c*.

The sellers (contractors) are profit maximizers who compete in a Bertrand setting in which they compete over price rather than quantity. I will use their model on Single Producer with Extended Warranty which looks at standard warranty versus extended warranty.

$$\text{EU} = \begin{Bmatrix} U(V - p^{ew}) + \delta_D U(V) \\ U(V - p^{w}) + \delta_D(\pi_2 U(V) + (1-\pi_2)U(0)) \end{Bmatrix}$$

Where

$U(V - p^{ew}) + \delta_D U(V)$ is the expected utility of the consumer if purchased an extended warranty with V is the value of the goods or services to the consumer, p^{ew} is the price of the good with the extended warranty, δ_D is the U.S. discount rate.

$U(V - p^{w}) + \delta_D(\pi_2 U(V) + (1-\pi_2)U(0))$ is the expected utility of the consumer if purchased with standard warranty where V is the value of the goods or services to the consumer, p^{w} is the price of the good with the standard warranty, δ_D is the U.S. discount rate.

$$\text{Expected Profit} = \begin{Bmatrix} p^{ew*} - \frac{c}{\pi_1} - \delta_P(\frac{c}{\pi_2} - c) \\ p^{w*} - \frac{c}{\pi_1} \end{Bmatrix}$$

Where

$p^{ew*} - \frac{c}{\pi_1} - \delta_P(\frac{c}{\pi_2} - c)$ is for the expected profit of the producer with p^{ew*} is the price of the good with the extended warranty, c is the cost of the produce to make the good, δ_P is the producer's discount rate, π_1 is the probability of success of the good in time period 1, and π_2 is the probability of success of the good in time period 2.

$p^{w*} - \frac{c}{\pi_1}$ is for the expected profit of the producer with p^{w*} is the price of the good with the standard warranty, c is the cost of the produce to make the good, and π_1 is the probability of success of the good in time period 1.

From this model, Dr. Myung and Dr. Khawam stated these lemmas:

- Lemma 2: When maximizing the total value (linear expected utility) and comparing the extended warranty plan and the standard warranty plan, the producer will provide the extended warranty plan if $\delta_D V \geq \delta_P \frac{c}{\pi_2}$. Otherwise, the produce will provide the standard warranty.
- Lemma 2.2: When maximizing the total value (linear expected utility) and comparing the extended plan and the standard warranty plan, the likelihood of providing the extending warranty increases as a function of δ_D and π_2 while decreasing in δ_P.
- Lemma 3: When maximizing the total value (linear expected utility) and comparing the standard warranty plan to the no warranty plan in the two-period setting, the producer will always sell the standard warranty, independent of the discount factor.

They concluded that considering the case of the two-period model with its ability to provide a standard warranty or extended warranty, if $\delta_D V \geq \delta_P \frac{c}{\pi_2}$, then the producer''s profit is the highest when providing a product with the extended warranty, second highest when providing the standard warranty, and the lowest when providing no warranty. Therefore, the producer will sell with an extended warranty. If not $\delta_D V \geq \delta_P \frac{c}{\pi_2}$, then the producer's profit is the highest when selling with the standard warranty and the producer will not sell the extended warranty or opt for no warranty.

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IV. ANALYSIS: HP PRINTER CASE STUDY

A. BACKGROUND

In February 2012, the 10th Sustainment Brigade (SB) requested a procurement purchase of 55 Hewlett Packet Color LaserJet M551xh Printers in order to replace the current Brigade Headquarters' printers that are critically failing and preventing the Brigade from performing basic level staff work in Afghanistan. Following the acquisition procurement process, the requesting activity initiated the requirement through the supply system by submitting a DA FORM 3953 (Purchase Request and Commitment) for signature and requisition number so that the printers can be accounted for on the property book. The supply sergeant created a memorandum acknowledging the procurement of the equipment with the requisition number and ensured the printers are in compliance with the Standardized Equipment List (SEL) because only certain name brand IT equipment are allowed on the secure network. The SEL deemed that HP and Xerox printers, plotters, and digital scanners are the only brand capable of providing the required interoperability with current printer configurations because failure to provide the HP or Xerox products will lead to significant compatibility problems with current equipment as United States Forces–Afghanistan (USFOR-A) works to standardize equipment throughout the theater.

The 10th Sustainment Brigade then forwarded the request to the Fiscal Triad for funding, legal review and procurement. In the request, the Commander (Colonel) acknowledged the purchase request of 55 HP Color LaserJet has been reviewed and meet all of the 10th SB's justification and distribution criteria. The Commander also stated that the 71 of the current printers' warranties are set to expire and require replacement. The Comptroller then issued a fund cite for the purchase of 55 printers, 55 toners and shipping to Afghanistan based on the three sales quotation and legal review from the Staff Judge Advocate (SJA). The SJA issued a legal review that the use of fiscal year 2012 Operation Maintenance funds is appropriate for this purchase and acknowledged that brand-name purchases are appropriate under 10 U.S.C. 2410 as implemented by the Federal Acquisition Regulation.

The Contracting Officer then award a contract to Hewlett-Packard Company for delivery of 55 HP Color LaserJet Enterprise CP4025dn printers for $1,183.01 each and 55 CE260A Toner for $160 each. The total cost of the contract is $83,905.55 which includes $10,040 for shipping to Bagram Air Base. The Contracting Officer issued this contract based on the market research conducted by USFOR-A J6 technical experts on the requirements for the USFOR-A SEL to determine which brands can fully meet the security and compatibility requirements of the network. This determination is based on the fact that the CHESS program contracts have already been competed and therefore costs have been determined fair and reasonable. In addition, there are several contractors involved in the CHESS program that are capable of offering the products. With multiple vendors offering the products, the government can be ensured that it is receiving best value.

B. WARRANTY

The purchased included the standard one-year, onsite warranty for each printer. However, Hewlett-Packard offers a 3-year extended warranty for $599 for the printer itself includes support packages that expand and extend standard warranties for HP hardware and software. HP Care Pack Services provide hardware and software support, installation services, education services and premium support options to meet the needs of business-critical IT environments. The product codes for the extended warranties are UG829E and UG830E, respectively, and can be found on the company site at hp.com.

With the harsh conditions in Afghanistan, units such as the 10th SB are replacing printers every year after the warranty expired. In this instance, the unit spent $83,905.55 for fiscal year 2012. As a concern taxpayer, units in Afghanistan can possibly save money by purchasing the extended warranty instead of buying new printers after each year because of the over usage and expired warranties.

C. SIMULATION

I conducted a Monte Carlo simulation in order to find the possible savings if the failure rates where high in the short term or long term and vice versa. In my first simulation, I first assigned a probability of 20% in which printers will fail within one year to take advantage of the standard warranty. I assigned a 70% to the printers that would fail by the three year mark to account for the extended warranty. The last 10% is for printers failing after the extended warranties. In this situation, where the probability is lower failure in the short term, it is more advantages to the government to pursue the extended warranty because of an average of 11.16% cost savings with the standard deviation of 3.51% after 200 simulations.

In the second scenario, I reversed roles and assigned the printers under the standard warranty a higher change of failing at 70% and 20% to the printers that will fail under the extended warranties. I found that after 200 simulations, the average cost savings is a negative 26% with a 5.60% standard deviation which makes sense because there is no additional cost for printers under the standard one year warranty.

In the third scenario, I applied a 45% probability of failure to printers in the standard and extended warranty and found that on the average the unit will incur a loss of 4.37% with a 4.68% standard deviation because of the 10% that is not covered under any warranty would drive the negative cost. Based on this simulation, the most realistic scenario for this unit would be first in which the printers would most likely fail after the standard warranty. Therefore, the unit should have plan and conduct a price analysis of the obtaining the 3 year warranty.

In the final scenario, I set the probably of failure for year 1 as a random number between 0 to .5 under a uniform distribution and the failure for year 3 as a random number between .25 and .75 under a uniform distribution. In this situation, the unit will take an average loss of -2.90% with a standard deviation of 10.17%. Therefore, the unit should take into account of just using the standard warranty at no cost for the printers.

Scenario	Probability of failure year 1	Probability of failure year 3	Average Total Savings	Average % Saved	Standard Deviation
1	0.20	0.70	$ 12,482.58	11.16%	3.51%
2	0.70	0.20	$ (20,097.51)	-26.00%	5.60%
3	0.45	0.45	$ (3,913.93)	-4.37%	4.68%
4	0 to .50	.25 to .75	$ (1,861.41)	-2.90%	10.17%

Table 1. Summary of Simulation Results

D. MODEL APPLICATION

Under Standard Warranty versus Extended Warranty of the Myung and Khawam economic model, I will use the equilibrium prices of p^{w*} and p^{ew*} to determine whether or not to advise the unit on pursuing the extended warranty. The current unknown values are V the value of the printers to the unit and π_2 the probability of success of the good in time period 2 or the extended warranty.

$$p^{w*} = (\pi_2)(\delta_D)V + V$$
$$p^{ew*} = (\delta_D)V + V$$

Using the government's (δ_D) discount rate of .75% found on Federal Reserve site at http://www.frbdiscountwindow.org/index.cfm, and prices found in the case study, I find that V = 894.35 and π_2 = 0.2654.

Since π_2 = 0.2654, the probability of failure in the extended warranty period is 1 - π_2 = 0.7346. This is similar to my simulation in scenario 2 when, I conservatively estimated the failure rate as .70 in the warranty period. Therefore, based on the model, I would advise the unit and contracting officer to seek the extended warranty in order to save total cost to the Army.

V. CONCLUSION

In this paper, I provided a literature review of the acquisition process. In the acquisition process, the opportunity for the Army to consider obtaining a warranty or extended warranty is prevalent throughout the process. The requesting activity and the supply system can start by requirement a warranty in the purchase request based on past experience or planned usage. The comptroller can also initial the warranty plan based on the cost analysis that is part of the office's technical expertise. The contracting officer can initial the warranty plan if he or she feels the warranty or extended warranty will be in the best interest of the government. The contractors will also be tempted to provide warranties or extended warranties to increase profit and cash flows. With the budget constraints the Army is facing, it would be prudent for everyone in the acquisition process to place an emphasis on obtaining warranty or extended warranty.

I have also provided an analysis of the formal model of an extended warranty versus standard warranty to show cost savings to the government based on the simulation of the printer failure rates of a past procurement of a unit in Afghanistan. The model showed that the producer will always want to sell with some type of warranty compared to no warranty in order to maximize profit (Myung, 2012). The extended warranty is more likely to be provided as the consumer becomes more patient, the producer becomes impatient, or the likelihood of the product failure does not increase too much in the extended period (Myung, 2012). The result of the model and simulation show that by making a large upfront purchase of an extended for 3 years versus the free standard warranty of one year, the unit can save on average 11.16% even though the likelihood of the product failure does increase in the extended period. While warranty planning is not required, this model can help the Army potentially save millions of dollars in day to day commercial products acquisitions.

Due to the budget constraints, Contracting Officers with the assistance of everyone in the acquisition process should emphasis extended warranty purchase in commercial products to reduce risk and lengthen life-cycle replacement cost to the government. Since the Army is one of the biggest buyers in the market, contracting

officers have leverage in negotiating extended warranties even though the regulation does not require them to do so. The Army has a regulation emplace for the warranty management program in AR 700–139, but I believe more guidance is needed from the Army's key leadership in order to fully realize the cost savings from extended warranties.

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